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Flight Evaluation of the Communications Earplug for Improved Situational Awareness in the F/A-18 E/F Super Hornet

P. Scot Best
Naval Air Systems Team, Operator-Vehicle Integration Branch (4.6.4.3)
Patuxent River, Maryland 20670
bestps@navair.navy.mil

Background

The F/A-18 E/F *Super Hornet* is the United States Navy's new long-range, multi-mission, all-weather strike fighter. As part of its multi-mission role, the *Super Hornet* will be used as an aerial refueling aircraft. The pilot of the aircraft to be refueled must fly in formation, driving the fuel probe of the aircraft into the fueling basket. The F/A-18 E/F operational evaluation (OPEVAL) reported excessive cockpit noise while flying in formation, receiving fuel from an F/A-18 E/F tanker (Figure 1). The noise levels have been described to be loud enough to allow aircrew to miss aural tones and/or radio/intercommunications system (ICS) transmissions during aerial refueling and close-in formations. Excessive noise has been found to compromise communications because of inadequate speech signal-to-noise ratio at the ear (Mozo & Murphy, 1997a).

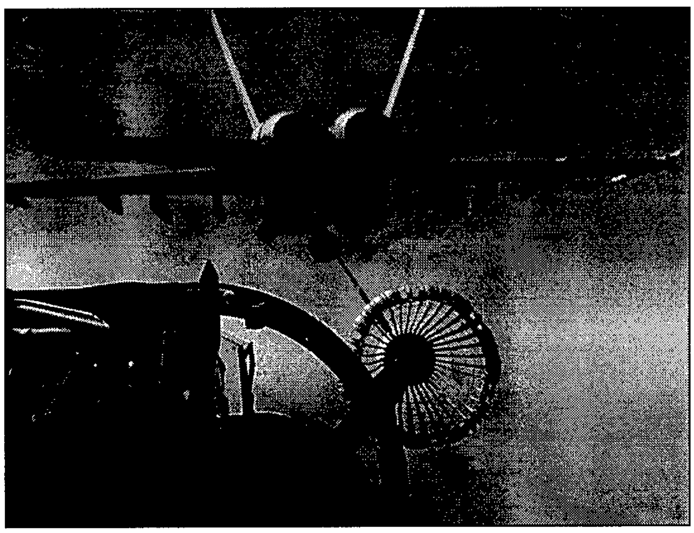


Figure 1: F/A-18 E/F *Super Hornet* serving as an aerial refueler.

Complaints of excessive cockpit noise have also come out of the rotary wing community. Noise levels found in military helicopters exceed noise exposure limits required by United States Department of Defense Instruction 6055.12, *Hearing Conservation Program* (1996). The steady-state noise levels in helicopters, particularly those with higher load capacities (e.g., CH-47, CH-46, H-53), are extremely high and sometimes exceed the helmet's capability to provide adequate hearing protection for the crewmembers (Ribera et al, 1995; Mozo & Murphy, 1997b). Typically, helicopter aircrew (pilots and crewmembers) use double hearing protection, consisting of personal protection earplugs ("foamies") with their standard helmet earcups. While this does provide the necessary hearing protection, it further compounds the problems associated with communications capabilities. The problem is that the helmet earphone output must overcome the attenuation of the earplugs to provide signals to the ear that are loud enough to be understood.

Passive Noise Reduction (PNR)

Traditionally, noise reduction for fixed and rotary wing aircrew has been provided by passive attenuation; the process of creating a physical barrier around the ear in an attempt to block out noise. This is normally achieved by using a combination of an earcup (to enclose the ear) and an earseal (to seal the cup to the head). The U.S. Navy/Marine Corps has approved Oregon Aero SoftSeal™ ear cushions as a passive noise reduction (PNR) modification to standard aviator helmets (Figure 2). However, despite the improved comfort and tighter fit of the ear cushions, noise can penetrate the earcup/earseal barrier through several paths: air leaks resulting from an imperfect seal around the ear (e.g., when wearing spectacles), vibrations of the mass of the earcup on the skin, and direct transmission through the imperfect rigid materials that comprise the earcup and earseal.

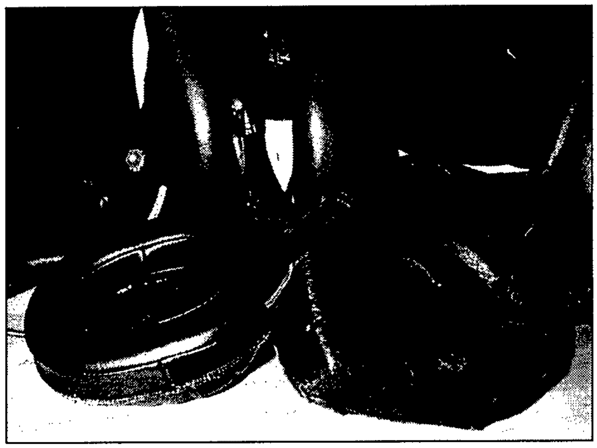


Figure 2: Oregon Aero SoftSeal™ ear cushions (left) and standard earcups (right) as installed on an HGU-68/P U.S. Navy TACAIR helmet.

In order to improve passive attenuation, it has been deemed necessary to: increase the air volume (making the earcup larger), decrease the air leak by tightening the seal and creating greater pressure against the head (potentially decreasing comfort), and increase the earcup mass (potentially decreasing comfort). All of these design features were unacceptable for the aircrew. These issues led the U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, Alabama, to develop and evaluate a new form of aircrew PNR; the Communications Earplug (CEP).♦ The development goal was to provide Army aviation with state-of-the-art communications equipment, capable of easily understood vocal messages, even in the highest noise environment of the helicopter.

The Communications Earplug (CEP)

The CEP is a device that is used to provide hearing protection and high quality speech communications to the user. The CEP device is a miniature dynamic earphone enclosed in a soft foam earplug worn inserted into the ear and in conjunction with the standard aviator helmet (Figure 3). The earplug is available in three sizes (short, slim, and standard) and has a coaxial, which provides a direct signal path from the earphone to the ear. CEP installation requires minor, reversible, modifications to the helmet, and no modifications to the aircraft. The CEP is

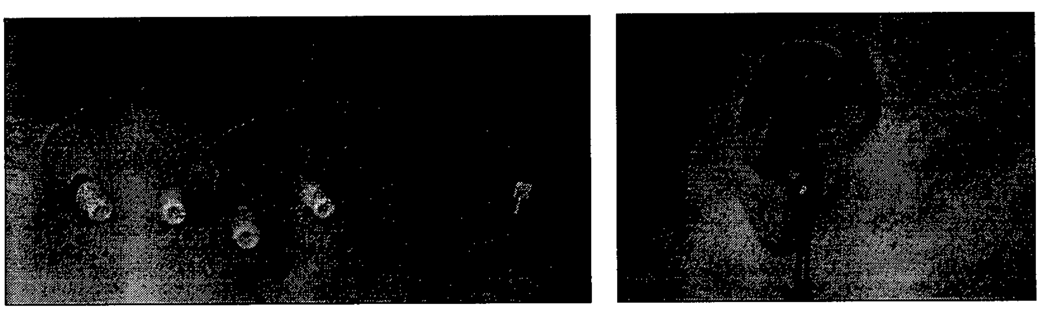


Figure 3: The Communications Earplug (CEP).

installed into the helmet by splicing the CEP interface cable assembly into the helmet's existing communication wires. The splice into the wire is made about three inches from the wall of the earcup and insulated with shrink tubing. The other end of the CEP interface cable assembly is terminated with a miniature connector which mates

♦The CEP is now produced and distributed by Communications & Ear Protection, Inc., Enterprise, Alabama.

with a connector on the CEP. In the U.S. Army rotary wing community, the CEP connector is held in place on the outer, lower, rear quadrant of the SPH-4 and/or HGU-56/P helmets by a metal bulkhead connector (Figure 4). The interface cable assembly incorporates an electrical attenuator, approximately 20 dB which is used to reduce the signals received from the ICS. The resulting acoustic signal at the ear is comparable to the signal produced by the earcup/earseal system in the helmet. Because the CEP communications circuit is parallel to the circuit in the helmet, if there was a failure of the CEP device, the existing helmet communication/earphone system would be unaffected and would allow normal communication to continue.

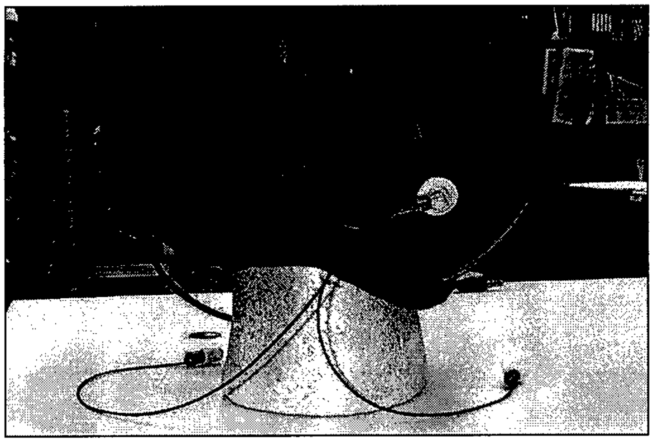


Figure 4: The CEP installed on an SPH-4 U.S. Army rotary wing helmet.

USAARL has performed several studies to evaluate the merits of the CEP as used in various U.S. Army helicopters, in terms of noise attenuation, improved speech intelligibility, user comfort, and user acceptability (Ahroon, et al, 2000; Mason & Mozo, 1995; Mozo & Murphy, 1997a; Mozo, Murphy, Ribera, 1995; Murphy & Mozo, 1999; Riberia, Mozo, & Murphy, 1996; Staton, Mozo, & Murphy, 1997). On all occasions, the CEP has been proven safe and effective. In 1996, Naval Air Systems Command (NAVAIR) requested USAARL and Naval Air Warfare Center Aircraft Division (NAWCAD), Patuxent River, Maryland, to conduct an assessment of the CEP in the U.S. Navy's CH-53D/E and CH-46E noise environments. Marine Helicopter Squadron One (HMX-1), Quantico, Virginia, was tasked to conduct the operational assessment. The results indicated that the CEP was an operationally suitable and cost effective technique that provided impressive improvements in sound attenuation and speech intelligibility (Mozo & Murphy, 1997b). Even with all the apparent success of the CEP tests and evaluations, no efforts have been put forth to test the applicability of such a system in fixed wing tactical fighter jets.

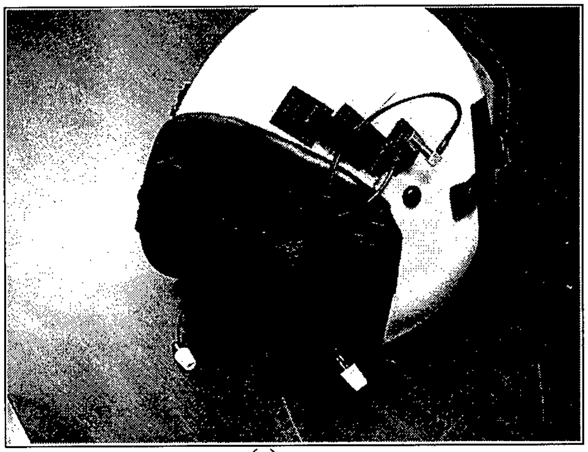
Objective

In response to the noise concerns during E/F OPEVAL, a plan was developed by Navy Crew Systems (AIR-4.6) and the F/A-18 E/F Integrated Test Team (ITT) to perform qualitative (quick look) assessments of available PNR systems. The PNR systems evaluated were: (1) A standard U.S. Navy/Marine Corps tactical aviation (TACAIR) helmet (HGU-68/P) modified with Oregon Aero SoftSeal™ ear cushions (hereafter referred to as SoftSeals) incorporating a tighter fitting, modified ear cushion and; (2) The CEP in conjunction with SoftSeals. The SoftSeals have long been approved for use during flight in all model helmets in the Navy/Marine Corps inventory. The purpose of this evaluation was to subjectively assess the CEP and the SoftSeals, as compared to the standard helmet, with focus on speech intelligibility, noise attenuation, fit, comfort, and situational awareness (SA) in the fixed wing cockpit.

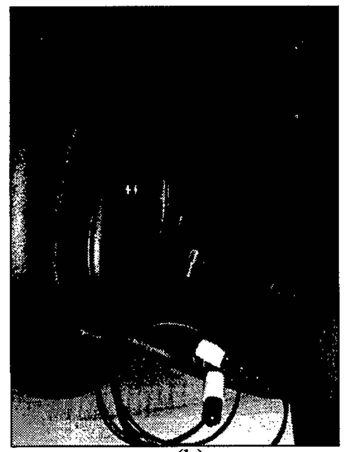
Methods and Results

Data collection was accomplished using questionnaires and on-site personal interviews of the test aircrew. The responses were used to assess the effectiveness of the CEP and the SoftSeals when compared to the unmodified helmet they currently use. The aircrew, assigned to the Naval Strike Aircraft Test Squadron, F/A-18 E/F Project Office, NAWCAD, Patuxent River, Maryland, were briefed on details of the project. A full description of the objectives and issues concerning the CEP and its use in the aviation environment was provided.

The aircrew were instructed on all aspects of the CEP to include proper insertion, replacement, and washing of earplug tips, limiting the volume level of the ICS at startup, and donning and doffing the helmet. They were also instructed on procedures to be used should an unexpected malfunction of the CEP occur. Two helmets were modified with the SoftSeals and the CEP; one was fitted to a test pilot and the other to a test Weapon System Officer (WSO). The original configuration of the CEP installation, used during the ground tests, had a connector mounted on the back of the helmet (Figure 5a). However, because of safety concerns associated with TACAIR ejection envelopes, the CEP connector was removed from the outside and stowed inside the helmet, in the cavity behind the earcup (Figure 5b) for all flight tests.



(a)



(b)

Figure 5: The CEP installed on an HGU-68/P U.S. Navy TACAIR helmet. (a) Ground test configuration. (b) Flight test configuration.

Ground and flight tests were conducted with the aircrew using multiple F/A-18 aircraft (A through F series). For all tests, subjective evaluation questionnaires were used to measure the aircrew's assessment of the CEP when compared to (1) the standard helmet, and (2) the helmet with SoftSeals. However, for the ground tests, the questionnaires only addressed the CEP for usability, functionality, and interoperability with aircraft systems, and did not seek comparisons with the standard helmet or the SoftSeals. In general, the questionnaires used either direct response or rating scale questions. Sufficient opportunity was provided for comments from the aircrew. The rating scale was based on a comparison with the standard helmet normally used. The questionnaires were given to the aircrew for their completion as they were able to schedule flights. The questionnaires were then submitted for review and analysis. Results of the questionnaires were reviewed to determine the acceptability of the CEP for use in the TACAIR environment.

Ground Test Methods. Prior to first flight with the CEP installed, ground tests were conducted utilizing two F/A-18 F aircraft to ensure all critical aural warnings, cautions, advisories, and normal communications were audible with a functional CEP, and not adversely degraded by failure of the CEP. The ground checkout required two ground turns (both engines turning); one turn for an aircraft configured with a Multifunctional Information Distribution System (MIDS) amplifier-control, intercommunication (ACI) and the other without the MIDS ACI. The tests were conducted first with, and then without, the CEP hardware connected to the helmet's audio (this served as a simulated failure of the CEP). The CEP earplugs remained in the test aircrew's ears throughout the test, regardless of whether or not it was connected to the helmet's audio. The standard F/A-18E/F pre-start, start, and before taxi checks, up to and including the flight control system initiated built-in test (FCS IBIT), were conducted. The aircrew (pilot and WSO) were asked to note any difficulties hearing the radio communications, warning tones and aural cautions, and any compensation required (to include any increase/decrease in the radio/ICS volume level).

Flight Test Methods. After the successful ground test of the CEP system, flight test evaluations were performed tag-along to planned E/F testing at Patuxent River. There were no specific or dedicated mission profiles during these tests. During flight testing, designated aircrew (with modified helmets) were in the receiver/chase position in an F/A-18 (A through F series) aircraft. E/F test flight missions included Air Refueling Store (ARS) testing, weapons separation and carriage capabilities testing, aerial refueling from a KC-130 (ALE-55 towline performance), field carrier landing practice (FCLP), and aerial combat maneuvers (ACM). Flight times ranged from 1.7 to 3.5 hours. An initial flight was performed with the SoftSeals-modified helmets, while all subsequent flights used the CEP-SoftSeals combination. Expectations were that the test aircrew would provide qualitative assessments on each of the helmet configurations flown with respect to the reduction in perceived noise levels. Specifically, were radio/ICS communications and aural cautions audible while tanking/chasing with a particular helmet configuration? Prior to the first CEP flight, snag issues (discovered during the ground tests) were remedied by placing the CEP connector inside the helmet.

Summary of Ground Test Results. Ground test results showed that the CEP system provided greatly reduced cockpit noise levels during engine turns and significantly clearer radio and ICS communication. Cockpit voice and aural tones were audible during simulated failures, but at a reduced level in the non-MIDS ACI aircraft. Failure of the CEP was easily diagnosed and the earplugs could be readily removed from the ears, restoring normal cockpit audio. The wires at the back of the helmet did snag on the upper life preserver unit (LPU) lobe, and required deliberate lateral head movements to avoid dislodging the CEP earplug from the left ear. There were no observed potential safety of flight issues with the operation of the CEP.

Aircrew/CEP Interface: Both aircrew reported that inserting the earplugs was time consuming, requiring multiple attempts to get the plugs seated properly in the ear canal. They also noted that this may improve with practice, but was an issue during the two ground tests. Connecting the CEP to the audio connection on the back of the helmet required significant dexterity and was not possible while wearing gloves. Once the helmet was donned, with the CEP connected to the helmet audio, there was a 5-6 inch exposed loop of wire behind the helmet. This wire occasionally snagged on the LPU and required slow head movements to avoid pulling the left plug from the ear. Depending on how the plug was seated in the ear, there were varying degrees of pressure applied to the speaker portion of the ear piece, which resulted in some pain in the ear (similar to a "hot spot" on a helmet). The test aircrew again noted, that with practice, properly seated plugs would lessen the occurrence of pain. While wearing the helmet and CEP, unseating and removing the plugs from the ears was found to be easy, requiring a simple tug on the wire while lifting the back of the ear cup.

CEP Operation: Normal operation of the CEP provided significant reduction in ambient noise and improvement in clarity of radio audio and voice/aural cautions. Auxiliary power unit (APU) and engine spool-up, for example, were barely audible with the CEP installed. This was noted to be similar to the noise level experienced when wearing standard foamy ear plugs with the baseline helmet.

During the simulated failure, an increase in radio volume (from the 1 o'clock to the 4 o'clock dial position) was required to clearly hear radio communications with earplugs still in the ear. In the non-MIDS ACI aircraft, cockpit voice/aural cautions were audible, but at a much reduced level. In the MIDS ACI aircraft, cockpit voice/aural cautions were clearly audible during the simulated failure. Further, ICS communication in the MIDS ACI aircraft was significantly degraded and required both test aircrew to yell into the oxygen mask to be heard. In both ground test simulated failures, a significant decrease in headphone ambient noise provided definitive cueing that the CEP had failed. The test aircrew found this was noteworthy, in that a CEP failure was easily diagnosed, which would allow for quick removal of the earplugs, restoring baseline cockpit audio.

Summary of Flight Test Results. The test aircrew flew multiple flights in separate F/A-18 (A through F series) aircraft. When flying, the test aircrew were the only ones using the CEP-SoftSeals (i.e., accompanying aircrew not involved with the CEP tests were using their standard helmets). When flying with just the SoftSeals, the test aircrew noted improvements in noise attenuation over their standard helmets, but not sufficient enough to address the problem of excessive cockpit noise when behind an E/F. When using the CEP-SoftSeals combination, the aircrew noted significantly reduced ambient noise levels and improved ICS, radio, and aural tone clarity. Issues arose concerning CEP user comfort during long duration flights, as well as CEP connector stowage problems. Following modifications to CEP installation and donning procedures, subsequent flight tests showed continued improvements in all areas.

Aircrew/SoftSeals Interface: Initial flights in an F/A-18D tested the SoftSeals as a stand-alone PNR system. Both aircrew reported that the SoftSeals were a much more form fitting ear seal as compared to the standard helmet configuration. However, this tighter fit caused the helmet to be slightly tougher to don. Further, the WSO reported headaches caused by the excessively tight fit. Smaller size SoftSeals were installed in his helmet, in turn reducing the pain.

SoftSeals Operation: Both test aircrew agreed that the SoftSeals provided a "slight reduction" in perceived ambient noise in the cockpit over their standard helmet. Additionally, improved comfort was reported due to the lack of direct pressure on the ear as found in the standard helmet. Overall, the Softseals as the sole PNR system was found to be "an incremental improvement in comfort and noise reduction."

Aircrew/CEP-SoftSeals Interface: Initial flights with the CEP showed that the aircrew found the donning procedures to be "time consuming", requiring several attempts to get the plugs properly seated. Donning procedures for the helmet took extra efforts, requiring different donning procedures and attention so as not to allow the SoftSeals to pull the CEP plugs out. The new connector stowage area (inside helmet) was "awkward" to reach, particularly because of the size and shape of the connector (large square mounting plate). The aircrew also reported difficulties in stowing the CEP connector inside the helmet while wearing their required survival gear.

The aircrew were also experiencing discomfort during long duration flights. It was determined that the pain was a function of the tighter fitting SoftSeals and improper seating of the CEP plugs in the ear canal. Further, the wiring coming out of each plug provided some discomfort where it was pressed against the ear cartilage by the SoftSeals. This required the test aircrew to perform several adjustments of the wires in flight to find a comfortable position.

Minor modifications to CEP donning procedures were made prior to test continuation. To address the comfort issues, better/proper earplug seating techniques were discussed and foam spacers ("shims") were removed from behind the earcups of each helmet. When necessary, the aircrew tried various sizes of CEP earplugs and SoftSeals to obtain a more comfortable fit. These changes helped improve comfort on subsequent flights. However, despite all efforts to improve overall comfort, the test pilot still reported some discomfort in the ear canal. He did note that the CEP plugs were getting more comfortable with each flight.* To address the stowage issue, a CEP connector extension cord was installed in the test pilot's helmet (Figure 6). This allowed the connector to be positioned in the helmet prior to donning, making the connection and stowage of the CEP wires easier. All CEP wires and connectors were stowed completely inside the helmet to address ejection/escape safety concerns.

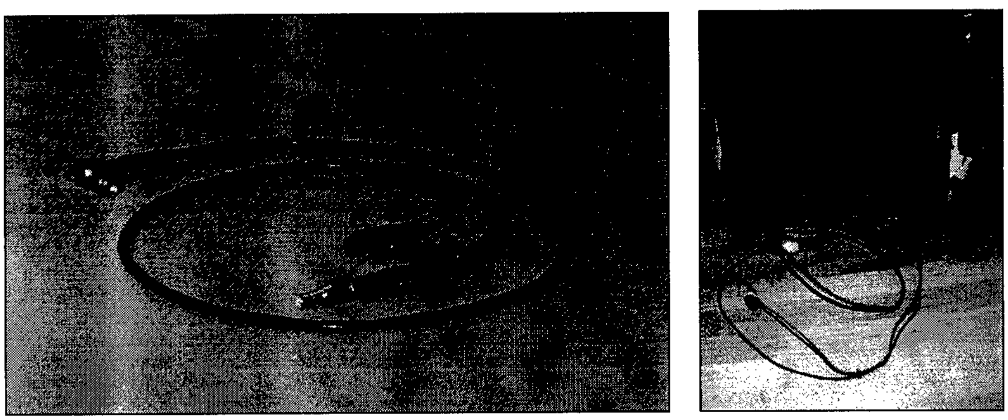


Figure 6: The CEP connector extension cord installed on an HGU-68/P U.S. Navy TACAIR helmet.

CEP-SoftSeals Operation: The first CEP flight tests were done from separate F/A-18D aircraft performing E/F chase missions. For these flights, the test pilot and test WSO flew in different aircraft, on different days. During the test pilot's flight, he was able to evaluate the CEP under normal flight operations and during a 'clean and dry' check of an E/F (the chase aircraft crosses under and behind the E/F; about 10 ft stepped down, 10 ft nose to tail). During the clean and dry check, the E/F was at a mid-range power level. The WSO tested the CEP under normal conditions only. Additional flights were flown in an F/A-18 E by the test pilot only. These flights involved weapons separation and carriage capabilities testing, ALE-55 towline performance testing, FCLP, and ACM. The CEPs were evaluated under multiple flight envelopes.

The radio and ICS were reported to be "incredibly clear" compared the standard helmet and the SoftSeals. The CEP-SoftSeals system allowed for reduced volume levels (of radio and ICS) compared to normal settings and provided "excellent noise attenuation in all parts of the envelope." The test WSO reported the volume level was actually reduced (11 o'clock position) from the normal setting (1-2 o'clock position).

The test pilot noted an increase in the ambient noise level while crossing under and behind the E/F and when refueling behind the KC-130, however the radio and ICS could clearly be heard without increasing their

*It should be noted that the test aircrew had not previously used earplug hearing protection and therefore may require some time to become accustomed to them. Reports of discomfort were not as prevalent in the helicopter community because they routinely use earplugs during flights.

volumes. The CEP-SoftSeals system provided a significant reduction in the ambient noise getting to the ears. This increased noise attenuation also reduced the magnitude of the aerodynamic cueing (external cueing, such as engine spool up and airflow over the canopy) that pilots use for reference when performing an aerial refueling mission. The test pilot stated that he was able to perceive sufficient external cueing to perform the task safely. It was concluded that the increased sound attenuation afforded by the CEP will not preclude awareness of audible noise generated by airflow/engine spool.

Overall, the CEP showed significant noise reduction and improved radio/ICS clarity during all test flights. However, both test aircrew report some level of discomfort while wearing the CEP for extended periods (both had flights of approximately two hours).

Summary and Conclusions

This effort gathered TACAIR aircrew qualitative data on two PNR systems (SoftSeals vs. CEP-SoftSeals combination), using the current, unmodified, HGU-68/P helmet configuration as a baseline of comparison. All data collected was in the form of aircrew comments, solicited via questionnaires and interviews, on each system. Comments for the ground and flight tests were very favorable for the CEP-SoftSeals combination system. Aircrew reported significantly increased noise reduction, enhanced communications, and improved SA with the CEP configuration over the unmodified and SoftSeals modified helmet configurations.

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Flight Evaluation of the Communications Earplug (CEP) for Improved Situational Awareness in the F/A-18 E/F Super Hornet

P. Scot Best
Naval Air Systems Team
Operator-Vehicle Integration Branch (4.6.4.3)
Patuxent River NAS, Maryland 20670

Background

- F/A-18 E/F *Super Hornet* is the U.S. Navy's new long-range, multi-mission, all-weather strike fighter
- E/F OPEVAL reported excessive cockpit noise while receiving fuel from an E/F tanker
- Loud enough to miss tones; radio/ICS communications

Background

- Excessive noise compromises communications because of inadequate speech signal-to-noise ratio at the ear
- Complaints of excessive steady-state cockpit noise from the rotary wing community
- Helicopter aircrew use double hearing protection; personal protection earplugs ("foamies") with their standard helmet earcups

Passive Noise Reduction

- PNR = process of creating a physical barrier around the ear in an attempt to block out noise
  - combination of an earcup (to enclose the ear) and an earseal (to seal the cup to the head)
  - imperfect system
- U.S. Army Aeromedical Research Laboratory (USAARL), Fort Rucker, Alabama, developed the Communications Earplug (CEP)
  - goal to provide Army aviation with state-of-the-art communications equipment, capable of easily understood vocal messages, even in the highest noise environment of the helicopter

Communications Earplug

- **Miniature dynamic earphone enclosed in a soft foam earplug**
  - worn inserted into the ear; attached to standard aviator helmet
- **Installed by splicing the CEP into the existing helmet communication wires**
  - acoustic signal at ear is comparable to signal from earcup/earseal system in helmet
  - CEP circuit is parallel to the circuit in the helmet; if CEP fails, the existing helmet comm/earphone system would be unaffected

USAARL and the CEP

- **From early 1990's; several studies to evaluate the CEP in various U.S. Army helos**
  - focus on noise attenuation, improved speech intelligibility, user comfort, and user acceptability
  - found to be effective/accepted in all tests
- **In 1996; study for NAVAIR / HMX-1 helos**
  - an operationally suitable and cost effective technique that provided impressive improvements in sound attenuation and speech intelligibility
- **To date, no efforts to test the applicability of CEP in fixed wing tactical fighters**

NAVAIR Test Objective

- Navy Crew Systems (AIR-4.6) and the F/A-18 E/F Integrated Test Team (ITT) performed qualitative assessments of PNR systems
  - (1) Standard TACAIR helmet (HGU-68/P) modified with Oregon Aero SoftSeal™ ear cushions
    - a tighter fitting, modified ear cushion
  - (2) HGU-68/P with CEP and SoftSeals
- Purpose: subjectively assess CEP and SoftSeals, with focus on speech intelligibility, noise attenuation, fit, comfort, and SA in the TACAIR cockpit

NAVAIR Test Methods

- Two test aircrew: 1 test pilot; 1 test WSO
  - assigned to the F/A-18 E/F test squadron at NAWCAD, Patuxent River, Maryland
- Data collection via questionnaires and on-site personal interviews
  - assess the CEP and SoftSeals compared to the unmodified HGU-68/P
- Ground and flight tests conducted using multiple F/A-18 aircraft (A-F series)

Ground Tests

- Ensure all critical aural warnings, cautions, advisories, and normal communications were audible with a functional CEP; not degraded by CEP failure
- First with, then without, the CEP connected
  - served as a simulated failure of the CEP
- Standard E/F pre-start, start, and before taxi checks

Ground Tests - Results

- Aircrew/CEP Interface:
  - donning CEP was time consuming
  - snagged on LPU
  - some pain in ear
  - easy to remove plugs with helmet on
- CEP Operation:
  - significant reduction in ambient noise
  - improved clarity of radio/ICS and aural cautions
  - still audible during simulated failures
  - failures easy to detect; ambient noise cues

Flight Tests

- Performed tag-along to planned E/F testing at Patuxent River
  - test aircrew used F/A-18 aircraft (A – F series)
  - performed aerial refueling, E/F chasing, wep sep, ACM, field carrier landing practice, ALE-55 towline performance
- Initial flight with SoftSeals; additional flights with CEP-SoftSeals combo
  - new CEP connector stowage in helmet cavity
- Qualitative assessments on each helmet configuration flown with respect to reduction in *perceived* noise levels

Flight Tests - Results SoftSeals

- Aircrew/SoftSeals Interface:
  - more form-fitting ear seal
  - slightly tougher to don
  - initial reports of headaches; used smaller sizes
- SoftSeals Operation:
  - "slight reduction" in ambient noise
  - "incremental improvement in comfort and noise reduction" as sole PNR

Flight Tests - Results CEP-SoftSeals

- Aircrew/CEP-SoftSeals Interface:
  - donning was time consuming; proper seat, tight fit
  - new connector stowage location "awkward"
  - discomfort during long flights
  - modifications included: remove shims, donning procedures, CEP extension cord
- CEP-SoftSeals Operation:
  - radio/ICS "incredibly clear"
  - reduced volume levels for radio/ICS
  - significant reduction in ambient noise
  - "excellent noise attenuation in all parts of the envelope"

Summary

- Gathered TACAIR aircrew qualitative data on two PNR systems (SoftSeals vs. CEP-SoftSeals)
- Comments for the ground & flight tests were *very favorable* for the *CEP-SoftSeals* combo system
- Aircrew reported *increased* noise reduction, *enhanced* communications, and *improved* SA with the CEP configuration over the unmodified and SoftSeals modified helmet configurations

Questions?

Scot Best
Human Factors Psychologist
Naval Air Systems Team
Operator-Vehicle Integration Branch (4.6.4.3)
voice: 301.342.9270
fax: 301.342.9305
e-mail: bestps@navair.navy.mil

Address Mail To:
P. Scot Best (4.6.4.3)
48110 Shaw Road, Unit 5
Bldg. 2187, Suite 2280
Patuxent River, MD 20670-1906